



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/692,722	10/27/2003	Hiroshi Morioka	032045	9699
38834 7590 08/13/2007 WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP 1250 CONNECTICUT AVENUE, NW SUITE 700 WASHINGTON, DC 20036			EXAMINER CHACKO DAVIS, DABORAH	
			ART UNIT 1756	PAPER NUMBER
			MAIL DATE 08/13/2007	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/692,722	MORIOKA, HIROSHI	
	Examiner	Art Unit	
	Daborah Chacko-Davis	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 May 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4-12,14-17,19 and 21-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4-12,14-17,19 and 21-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>02/07</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 22, is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 22, at lines 2-3, recites, "the size of the photosensitive resist material and the antireflection film". It is not clear as what is meant by the reduction of the size of the photosensitive resist material and the antireflection film. Claim 1, recites coating a photosensitive resist material. Neither claim 1, nor claim 22, discloses i) a size of the photosensitive resist material and the antireflection film, and ii) how the size of a photosensitive resist material coating can be reduced. Appropriate correction is required.

3. Claim 22, at line 2, recites the limitation "said antireflection film". There is insufficient antecedent basis for this limitation in the claim.

4. Claim 22, at lines 2-3, recites the limitation "the size of the photosensitive resist material and the antireflection film". There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-2, 4-6, 9-12, 14, 17, 19, and 21-22, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 6,579,808 (Cho et al., hereinafter referred to as Cho) in view of U. S. Patent No. 6,110,826 (Lou et al., hereinafter referred to as Lou).

Cho, in the abstract, in col 2, lines 53-67, in col 3, lines 18-67, in col 4, lines 1-60, discloses a patterning forming method of forming a gate layer on the substrate, followed by an insulating layer, forming an organic antireflection layer on the insulating layer, forming a photoresist layer on the antireflecting layer, performing an exposure and development process on the photoresist layer to form a photoresist pattern (substrate at about room temperature), dry etching the sidewalls and top portions of the photoresist pattern using SO_2 , and He as the etch gas mixture, wherein the second gas i.e., SO_2 gas forms or generates polymer; etching the antireflecting layer using the resist pattern as the mask, etching the insulating film (first film) using the patterned antireflecting layer as the mask, removing the resist pattern and the patterned anti-reflecting layer, forming the gate structure (not shown) underlying the insulating film pattern (claims 1, 4-5, 9-11, 14, 17, and 19). Cho, in col 3, lines 28-31, discloses that the semiconductor substrate further includes implanting ions to form source and drain regions, and a gate (claim 21). Cho, in col 4, lines 14-17, and lines 44-52, discloses that the over etch performed on the antireflecting coating and photoresist film results in a reduced dimension of the same (claim 22).

The difference between the claims and Cho is that Cho does not disclose that the flow rate of the first gas is equal to or greater than 40% of a flow rate of the mixture gas. Cho does not disclose that the mixture of etch gases includes oxygen (claims 2, 6, 12).

Lou, in col 6, lines 1-15, discloses that the mixture of gases includes oxygen, and that the flow rate of the first gas i.e., helium (He) is at least greater than 40% of flow rate of the mixture of gases.

Therefore, it would be obvious to a skilled artisan to modify Cho by including oxygen in the mixture of etch gases, and by utilizing the gas flow rates suggested by Lou because Lou, in col 6, lines 1-15, discloses that after the image formation of the line trench in the photoresist layer, a plasma etch is performed on the exposed photoresist using etch gases such as O₂, SO₂, and He in the claimed flow rate, so as to continue the etch process until the etch stop layer is reached while forming a line trench pattern in the underlayer. Although, Cho does not disclose implanting ions to form the source and drain regions after step (o) of claim 10, It would be obvious to a skilled artisan to implant after the removal of the resist pattern (PR pattern) and patterned antireflection film (AR pattern) because Cho, in col 3, lines 31-32, discloses that the semiconductor substrate has a transistor, i.e., source and drain regions are to be formed, and in figure 3D illustrates the removal of the AR pattern and PR pattern corresponding to the conductive region i.e., the source/drain region can be implanted to form conductive regions (see reference 202).

7. Claims 7-8, and 15-16, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 6,579,808 (Cho et al., hereinafter referred to as

Art Unit: 1756

Cho) in view of U. S. Patent No. 6,110,826 (Lou et al., hereinafter referred to as Lou) as applied to claims 1-2, 4-6, 9-12, 14, 17, 19, 21-22, above and further in view of U. S. Patent No. 6,187,688 (Ohkuni et al., hereinafter referred to as Ohkuni).

Cho in view of Lou is discussed in paragraph no. 6.

The difference between the claims and Cho in view of Lou is that Cho in view of Lou does not disclose increasing the flow rate of the SO₂ gas to a flow rate of the oxygen gas during etching (claims 7, and 15). Cho in view of Lou does not disclose that the flow rate of SO₂ gas is increased when the time necessary for etching a whole thickness of the antireflection film elapses (claims 8, and 16).

Ohkuni, in col 10, lines 50-53, in col 11, lines 1-29, discloses that the flow rate of the SO₂ gas is maintained higher than the flow rate of the oxygen during the dry etch process of the antireflecting film.

Therefore, it would be obvious to a skilled artisan to modify Cho in view of Lou by employing the flow rate of the SO₂ gas as suggested by Ohkuni because Ohkuni, in col 13, lines 63-67, discloses that increasing the flow rate of the SO₂ gas results in a positive size variation in the sidewalls of the antireflection pattern.

8. Claims 23-26, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 6,579,808 (Cho et al., hereinafter referred to as Cho) in view of U. S. Patent No. 6,110,826 (Lou et al., hereinafter referred to as Lou) as applied to claims 1-2, 4-6, 9-12, 14, 17, 19, 21-22, above and further in view of U. S. Patent Application Publication No. 2003/0134231 (Tsai et al., hereinafter referred to as Tsai).

Cho in view of Lou is discussed in paragraph no. 6.

The difference between the claims and Cho in view of Lou is that Cho in view of Lou does not disclose that the etching of the resist pattern reduces the width of the resist pattern (claims 23-26).

Tsai, in [0007], discloses that SO_2/O_2 mixture gas is used to reduce the resist pattern width (reduction in critical dimension, i.e., reduction in pattern width).

Therefore, it would be obvious to a skilled artisan to modify Cho in view of Lou by performing the etch process suggested by Tsai to reduce the pattern width because Tsai, in [0007], discloses that performing the etch process on the resist pattern increase the etching process anisotropy and reduces microloading effects.

9. Claims 27-30, are rejected under 35 U.S.C. 102(e) as being unpatentable over U. S. Patent No. 6,579,808 (Cho et al., hereinafter referred to as Cho) in view of U. S. Patent Application Publication No. 2002/0061654 (Kanegae et al., hereinafter referred to as Kanegae).

Cho, in the abstract, in col 3, lines 18-67, in col 4, lines 1-60, discloses a patterning forming method of forming a gate layer on the substrate, followed by an insulating layer, forming an organic antireflection layer on the insulating layer, forming a photoresist layer on the antireflecting layer, performing an exposure and development process on the photoresist layer to form a photoresist pattern (substrate at about room temperature), dry etching the sidewalls and top portions of the photoresist pattern using SO_2 , and He as the etch gas mixture; etching the antireflecting layer using the resist

Art Unit: 1756

pattern as the mask, etching the insulating film (first film) using the patterned antireflecting layer as the mask, removing the resist pattern and the patterned antireflecting layer, forming the gate structure underlying the insulating film pattern (claims 27, and 28).

The difference between the claims and Cho is that Cho does not disclose that the first gas is selected from the group consisting of Ne, Ar, Xe, Kr, CO, CO₂, and N₂. Cho does not disclose that the first gas is selected from the group consisting of CO, CO₂, and N₂ (claims 29-30).

Kanegae, in [0168], discloses that a rare gas such as Ar, Kr, Xe, Ne etc., is mixed with the main etching gas used for plasma etching. Kanegae, in [0168], discloses that the CO or CO₂ can be added to the main etching gas.

Therefore, it would be obvious to a skilled artisan to modify Cho by employing one of the rare gases suggested by Kanegae because Cho includes a rare gas such as He in the etch gas mixture, and Kanegae, in [0168], discloses that using any one of the rare gases (noble gases such as He, Ne, Ar, Kr, Xe, etc.,) dilutes the etching gas, increases the discharge rate of the gas in the reaction chamber, and controls the electron temperature of the plasma. It would be obvious to a skilled artisan to modify Cho by including CO or CO₂ in the etching gas mixture as suggested by Kanegae because Kanegae, in [0168], teaches that adding CO or CO₂ in the etching gas mixture improves the etching ability of the resist pattern as an etching mask.

Response to Arguments

10. Applicant's arguments, see Remarks, filed May 22, 2007, with respect to claims 27-28, have been fully considered and are persuasive. The 102(e) rejection of Cho et al., made in the previous office action (paper no. 20070118) has been withdrawn.

However, upon further consideration, a new ground(s) of rejection is made in view of U. S. Patent Application Publication No. 2002/0061654 (Kanegae et al., hereinafter referred to as Kanegae).

A) Applicants argue that Cho et al., does not teach the limitations of claims 27-28, i.e., the etch gas is comprised of SO₂, and at least one of Ne, Ar, Xe, Kr, CO, CO₂ or N₂.

Cho teaches the use of sulfur dioxide along with an inert gas such He (first gas) as the etching gas. However, Cho is not depended upon to disclose the first gas recited in claims 27-28, See paragraph no. 5. Kanegae is depended upon to disclose the claimed first gas.

B) Applicants argue that there is no motivation of using the etch gas of Lou for the device of Cho.

Cho teaches the use of an oxygen containing gas such as SO₂ along with an inert gas as an etch gas mixture. Lou teaches in col 6, lines 1-15, that the photoresist pattern on the IMD layer is exposed to an etch plasma preferably comprising SO₂, O₂, and He, i.e., the PR pattern is subjected to etch on the sidewalls and surfaces during the exposure to the etch gas, and that using the claimed etch gas mixture in the claimed sccm range (flow rate) results in the removal of the underlying etch-stop layer from the bottom trench along with the transfer of the pattern of the resist layer to the IMD layer

i.e., the instead of only transferring the pattern to the IMD layer during an etch process, using the claimed etch gas mixture results in both elimination of the etch-stop layer in the bottom portion of the trench to be formed and (at the same time) transfer of the pattern from the resist layer to the IMD layer.

C) Applicants argue that both Cho and Lou teach etching of different materials using the SO₂ and He as the etch gas.

The claims recite exposing the resist pattern to a plasma of a mixture of gases i.e., SO₂, He, etc. Both Cho and Lou teach exposing the formed resist pattern to a further etching gas mixture comprising the same gas mixture (SO₂, He etc.) i.e., the etch gas mixture will perform both sidewall and surface topography variations on the resist pattern due to such a plasma etch process.

D) Applicants argue that Cho teaches away from the inclusion of oxygen in the etch gas as cited in col 3, lines 62-63.

Cho does not teach away from the use of oxygen in the gas mixture. The argued citation merely discloses the reactivity rate comparison of SO₂ to that of O₂ gas. Also the first dry etch process taught by Cho only discloses the use of SO₂ and He. Therefore, Cho does not disclose that oxygen cannot be added to the etch gas mixture of SO₂ and He.

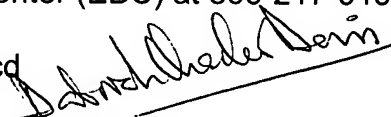
Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daborah Chacko-Davis whose telephone number is (571) 272-1380. The examiner can normally be reached on M-F 9:30 - 6:00. If

Art Unit: 1756

attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

dcg


August 9, 2007.